Fuel Optimal and Accurate Landing System Test Flights (FOALS)

Problem Statement

- To date robotic planetary landers cannot "see" landmarks for navigation or compute fuel optimal trajectories autonomously
- FOALS will mature terrain-relative navigation (TRN) and autonomous optimal guidance by demonstrating a complete pin-point descent and landing system for planetary landers
- Technology enables Mars pinpoint landing and small body sample return missions

Technology Development Team

- PI: Andrew Johnson, JPL, aej@jpl.nasa.gov
- Funding: JPL
- Technology partner: NASA/JPL Autonomous Ascent and Descent Powered-Flight Testbed (ADAPT) and Lander Vision System (LVS) teams

Proposed Flight Experiment

Experiment Readiness:

- Test flights will be conducted during December 2014.

Test Vehicles:

- Masten Space Systems' Xombie

Test Environment:

- Test flight trajectories proposed are scaled-down Mars-like powered descent trajectories
- Desired flight velocities at low altitude are not achievable with any other vehicle

Test Apparatus Description:

- FOALS payload consists of a compute element and power distribution systems pictured below in its flight configuration, an image processing system (not pictured) and the sensor suite consisting on a camera and an IMU (not pictured)
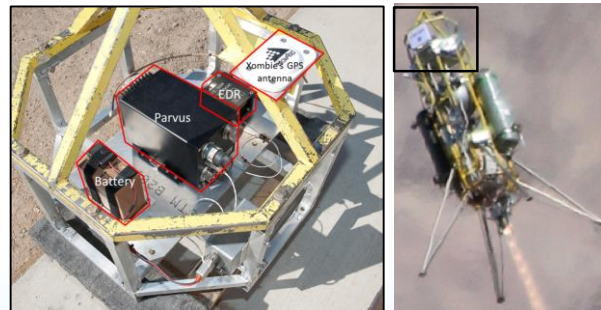
Technology Maturation

- Optimal autonomous guidance technology is at TRL 5; terrain-relative navigation is at TRL 4.
- Technology maturation will include helicopter test flights before demonstration flights onboard Xombie
- FOALS will demonstrate the combined technology in a relevant environment, advancing it to TRL 6

Objective of Proposed Experiment

- Test flights objective: demonstrate combined technology TRN + optimal descent guidance in relevant environment
- Navigation data will be used to increase robustness of TRN
- Trajectory data will be used to assess performance and drive future enhancements